DIFFERENTIAL REINFORCING EFFECTS OF ONSET AND OFFSET OF STIMULATION ON THE OPERANT BEHAVIOR OF NORMALS, NEUROTICS AND PSYCHOPATHS

By

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CHAPTER I

INTRODUCTION

A relatively operational method of learning about an individual's needs is to observe precisely what he will and will not expend effort to obtain. Thus, an individual whose behavior is directed toward obtaining a particular object may be assumed to "need" that object. It has been shown that most individuals will make responses to obtain certain things beyond the physical necessities (Greenspoon, 1955). Among these generalized reinforcers are praise and recognition expressed verbally or in movements such as head nods. Various studies, however, suggest that even generalized reinforcers do not lead to the same effect when different personality groups are investigated (Long, 1960; Spires, 1960; Binder and Salop, 1961). That is, while certain reinforcers may satisfy the needs of one individual, other needs which are prevalent in persons of different personality make-up will lead them to respond more persistently for other reinforcers. By differentially establishing just what it is that an individual will respond for, it is possible to determine differentially many of his needs. More specifically, if an individual repeats a response at an increasing rate when it is followed by a certain result, it may safely be assumed that that which followed the response is reinforcing to the organism (Skinner, 1938). This, of course, involves operationally defining the reinforcer in terms of the rate of responding following its presentation. It follows, then, that if other conditions remain the same, an individual shows an increase in his rate of emission of plural nouns when they are followed by an approving mmm-hmm (Greenspoon, 1955) it is quite safe to say that mmm-hmm is reinforcing to him or, to get away from the operational level, he has a certain need to obtain praise or recognition.

From these empirical findings, one might speculate on the possibility of a system of diagnosis derived from the behavioral determination of these hierarchies of needs. This line of reasoning, quite obviously, rests upon the assumption that groups of people can be meaningfully differentiated by establishing their particular motivations or reinforcers. The experimental groundwork still remains to be laid, however, and probably the most logical way to begin is to find two groups of people who supposedly differ in their essential pattern of behavior but within which there is assumed to be relatively little intragroup variation. These requirements, of course, are difficult to meet but by systematically selecting groups which are theoretically at opposite ends of a continuum and between which there is a great deal of conceptually validated variation, these requirements are satisfactorily handled. Two clinical groups which are amenable to an approach of this sort seem to be anxiety neurotics and psychopaths (or sociopaths). In marked contrast to the neurotic, the primary psychopath is, among other things, superficially very attractive , rational, not overtly anxious, irresponsible and lacking in affect (Cleckley, 1941; Thorne, 1959). These contrasting groups have been the focus of a great amount of work, often of a speculative rather than an experimental nature.

Through factor analysis, Eysenck (1955) derived two orthogonal dimensions, neuroticism and introversion-extraversion. Neuroticism is defined as "an inherited autonomic overreactivity" and "introversion is characterized by strong conditionability" (p. 21). With these constructs, Eysenck has attempted to account for those patterns of behavior previously handled by standard (Kraepelinean) nosology. His primary division has been between "dysthymics" and "hysterics" (1957). The former, including such types as anxiety states, obsessive-compulsives, mixed cases and depressives, are supposedly high on neuroticism and introversion while hysterics and psychopaths are identified by a high degree of neuroticism and extraversion.

Eysenck's dependence upon relatively untestable constitutional explanations, however, seems to beg the question and the issue of etiology remains largely open to controversy. Franks (1957) seems to have added little to the problem of dynamics and etiology but instead, following Eysenck, reverts to a constitutional approach. Administering the "Maudsley" questionnaire, he separated "introverted" and "extraverted" subjects. Although he found a relationship between Maudsley introversion and eyeblink conditionability, the meaningfulness of this result is, at best, inconclusive.

Tong and Murphy (1960) note that "the main problem of the explanation of individual differences in terms of excitation and inhibition is to relate this to the overt behavior patterns which constitute psychiatric illnesses or behavior disorders" (p. 1285). It would appear that such a justifiable proposal is a criticism of much of Eysenck's work with the Maudsley questionnaire. While Tong and Murphy's suggestion that an emphasis on the inhibitory factor as a variable in the learning of fear responses would circumvent this problem, it is likely that the more operational approach, as discussed above, is perhaps a better solution to the general problem of diagnosis.

Cleckley (1941), probably one of the foremost writers on psychopathy, describes the psychopath in the following manner:

> Not only is he undependable but also in more active ways he cheats and lies without any apparent compunction. He will commit theft, fraud and other deeds for astonishingly small stakes and under much greater risks of being discovered than will the ordinary scoundrel. He will, in fact, commit such deeds in the absence of any apparent goal at all (p. 240).

Using certain of Cleckley's diagnostic criteria, Lykken (1957) observed that subjects diagnosed primary sociopaths and revealing such symptoms as impulsiveness and lack of normal affect in experience were unable to accrue anxiety in a shock avoidance situation as were normals and neurotics. In addition, the primary sociopaths scored significantly lower than neurotics and normals on the Taylor MAS and the Welsh Anxiety Index and showed less GSR reactivity to a conditioned stimulus associated with shock. This seems to indicate that psychopaths, unlike neurotics, are able to handle even traumatic stimuli easily without the accumulation of anxiety.

It is clear from Cleckley's description, which is in accordance with the general picture of the "psychopathic personality," that such individuals tend to manifest behavior which is excessively active. While the traditional interpretation of such activity involves a lack of impulse control (Fenichel, 1945), there is another way of dealing with this phenomenon which does not refute but rather complements this interpretation. It may be argued that the pattern of hyperactive and antisocial behavior characteristic of the clinical group called psychopathic does not merely reflect a failure to experience anxiety but may be considered a positive attempt to gain stimulation from the environment in an active manner. Thus, it would follow that in Lykken's study reported above, the failure of the psychopathic group to learn a shock avoidance response could just as readily be interpreted as demonstrating a need by this group to receive stimulation, however painful, from the environment. The shock, in fact, may be considered a positive reinforcer which led to an increase in non-avoidance responses. Furthermore, the rapid avoidance response acquisition on the part of the neurotic group may suggest, conversely, that this group reflects a strong need to avoid stimulation and that the traumatic effect of receiving shock made the avoidance of such shock a powerful reinforcer. A series of studies by Petrie and her collaborators seems to lend considerable support to this theoretical formulation.

Petrie *et al.* (1958) proposed a central sensory process to account for experimental findings related to stimulation satiability. It was suggested that this process is in part the mechanism determining the relative degree of stimulation tolerance and that individuals who could tolerate a great deal of pain due to an ability and need to handle large amounts of stimulation would suffer in a situation in which environmental stimulation was minimized. On the other hand, a pain intolerant individual is one who subjectively exaggerates the intensity of a given stimulus and as a result should function fairly well even in a sensory deprivation situation providing even minimal stimulation. Petrie (1960) coined the terms "Reducer" and "Augmenter" to describe these contrasting types. Using a kinesthetic satiation apparatus, Petrie had blindfolded subjects rub their fingers over a block of wood for a given period of time. She then required them to rub their fingers over a much larger block. Finally, employing a tapered piece of wood, she had her subjects estimate the width of the original block. Certain subjects tended to overestimate consistently (augment) while others showed a tendency to underestimate (reduce) the size of the block. These individual patterns were apparent even when the order of presentation of the different blocks was reversed. Discussing this phenomenon, Petrie notes that these two contrasting processes reflect different personality types. Since the Reducers subjectively diminish the intensity of stimulation from the environment, it was not unexpected to find that these individuals were considerably handicapped in a sensory deprivation situation and voluntarily remained in a tank type respirator for a significantly shorter time than the Augmenters. However, as this theory would predict, the Reducers were significantly more able to tolerate pain than the Augmenters.

In an attempt to relate these findings to the behavior of clinical groups, Petrie _et al_. (1960) used the Maudsley questionnaire. They suggest that psychopaths, as defined by Maudsley criteria, correspond quite closely to Reducers. This indicates that the contrasting tendencies to reduce and augment incoming stimuli may be the common denominator underlying the traditionally observed differences between anxiety neurotics and psychopaths. More specifically they note:

> One may think of the Reducer as being, in his day to day life, subjected to some sensory deprivation: the greater his tendency to reduce, the greater his deprivation. The results of our experiment suggest that the intensity of his sensory experience (including pain) is mitigated because of his tendency to reduce - his tendency to diminish the apparent size of the object. This person is intolerant of further deprivation. At the other end of the spectrum are those whose incoming perceptions are least diminished by previous perception, who have their pain and other

> sensations "neat" and undiluted, in whom pain is cumulative, and who more readily tolerate sensory deprivation. . . . He who in sensory deprivation is starved of sensation may find that pain, as a sensation, constitutes an alleviation of his stress (p. 89).

If one considers the psychopathic personality pattern as a manifestation of a need to increase stimulation, the excessive activity and antisocial behavior of the psychopath, as well as his tendency toward recidivism and self defeating, pain producing behavior, may be more clearly understood. Furthermore, the inability of highly anxious individuals (anxiety neurotics) to tolerate a high degree of stimulation, a usual clinical finding, can also be readily accounted for through this approach.

In an effort to examine the relationship between psychopathic behavior and the tendency to diminish the intensity of incoming stimulation, Petrie *et al.* (1962) tested a group of juvenile delinquents to determine the directionality of perceptual distortion. Since the delinquent has been described as particularly intolerant of monotony and restriction of activity, it was hypothesized that this was related to his subjective reduction of stimulation. The results supported this, the delinquent group contained significantly more Reducers and particularly more extreme Reducers than the nondelinquents. In addition, the delinquent group had significantly fewer Augmenters than the nondelinquents. The writers describe the circumstances of the delinquent as follows:

> Suffering is the fate of the Reducer subjected to monotony, isolation and restriction of activity. One can think of the Reducer as being in a state of threatened perceptual deprivation. In order to hang on to his "feeling of reality" he becomes greedy for sensory input - sensory input of any kind - and this necessity thus constitutes the area of his vulnerability (p. 418).

In these terms, then, Petrie and her collaborators make it apparent that they regard the psychopath as revealing, in his behavior, a continual need for environmental stimulation. Conversely, it may be inferred that the anxiety neurotic, unable to handle even normal stimulation, seeks relief from an excessively stimulating environment. While the etiology of these respective patterns has not been considered by Petrie, it is not necessary to infer a physiological basis. It is at least as likely that these are learned patterns of responding to essentially different early environments. More specifically, the Reducer, while an infant, may have been confronted by an excessively stimulating environment. In an effort to avoid trauma, he may have overlearned to perceptually reduce the intensity of incoming stimulation. Conversely, the Augmenter, having an early environment in which sensory stimulation was limited, may have over-learned a pattern of perceptual vigilance to obtain adequate sensory stimulation. At any rate, while this explanation is necessarily quite speculative, it may shed some light on the nature of the processes observed.

Furthermore, Petrie's explanation of psychopathic behavior and her implications regarding neurosis seem quite compatible with the orthodox psychoanalytic interpretation. Fenichel (1945) discussing the importance of "mental economics," has noted:

> Another example of the usefulness of the economic concept is seen in the fact that neuroses frequently break out at puberty and at the climacterium. The person affected was able to withstand a certain amount of undischarged instinctual excitation; however, when physical changes increased the absolute quantity of this excitation, the countermeasures no longer sufficed. Countless other examples exist which bring home the importance of the economic point of view for the understanding of factually observed phenomena. The person who was tired after having done nothing

> represents but a special type of general inhibitions due to silent internal tasks. Those who have inner problems to solve must apply a great deal of their energy to them, and there remains little for other functions (p. 14).

From this description, it can be inferred that the neurotic, expending a great deal of energy in psychological conflicts, and consequently having little energy left to deal with additional stimulation, experiences such stimulation as threatening to an already overtaxed organizational system. In an effort to cope with this subjectively intensified stimulation, he may resort to the constriction of behavior characteristic of the neurotic. Conversely, the psychopath or "instinct ridden character" (Fenichel, 1945), has an incomplete or pathological superego and an inefficiently operating ego. As a result, he is unable to tolerate tension and "acts out" in an effort to reduce it. This, however, may constantly reduce the tension level of the psychic economic system to an excessive degree, manifesting itself in the perceptual behavior and activity seeking of the Reducer. It is this overlearned pattern of tension reduction, then, which may be held to account for the psychopath's constant search for new sources of stimulation.

Unfortunately, there have been no studies in which Petrie's Reducer-Augmenter hypothesis has been investigated through an operant technique. That is, while people have been assumed to differ along this continuum, there have been no studies in which the logical extrapolation has been made that psychopaths (Reducers) and anxiety neurotics (Augmenters) should seek or attempt to modify general stimulus intensity so that it will coincide with their related reducing or augmenting tendencies. The few operant studies of differential reinforcers in relation to personality have been largely in regard to schizophrenic disorders and usually it is the rate of conditioning rather than specific types of reinforcers that is the subject of investigation (e.g., Mednick and Lindsley, 1958). One such study, however, dealing specifically with differential reinforcers and normal vs. psychopathic criminals was performed by Kadlub (1956). In separating his psychopathic and "normal" criminal groups, Kadlub used such criteria as previous court and institutional record, type of military discharge, current institutional adjustment, diagnosis, prognosis and type of offense. Using a split half design, he found no significant difference between these groups in the rate of learning of nonsense syllables for verbal (praise) vs. nonverbal (e.g., cigarettes) reinforcement. However, his classification criteria as well as his use of "normal" criminals are somewhat questionable and his rote learning task may have been contaminated by individual differences in memory.

One of the most obvious shortcomings of many of the studies referred to is the criterion employed to differentiate groups of subjects. As has just been noted, for example, it is quite difficult to accept the assumption that there exist two such groups as "normal" and psychopathic criminals which can easily be separated by looking through institutional records. Kingsley (1960) has found that groups of criminals divided into normals and psychopaths did not, nevertheless, show significant differences on the Welsh Anxiety Index or the Pd scale of the MMPI. One way to account for this is to challenge these tests in terms of discriminative ability; another, however, is to attribute this result to a more basic similarity between normal and psychopathic criminals than has usually been assumed.

The MMPI has been used as a criterion in the formation of diagnostic groups in several studies which involve the differentiation of such groups with regard to other variables. Binder and Salop (1961) found that subjects above the median scale score for the various MMPI scales differed in rate of verbal conditioning from subjects who scored below the median but the results were too vague to be interpreted unambiguously.

Spires (1960) compared high 3 (hysteric) and high 7 (obsessive-compulsive) subjects on a verbal conditioning experiment in which "good" and "uh-uh" were used as positive and noxious reinforcers, respectively. The obsessive-compulsive group showed significantly less conditioning than the hysteric group under the positive reinforcement situation, again bringing into question the value of generalized reinforcers across diagnostic categories.

Warren and Grant (1955) divided elementary psychology students into two groups on the basis of whether they scored above or below the 65th percentile on the MMPI Pd scale. It was hypothesized that the high Pd group would tend to seek immediate impulse gratification and avoid an annoying situation (a puff of air) to a greater extent than the low Pd group; there was no significant difference between the groups in terms of rate of responding to the positive stimulus. The writers conclude that the inability of high Pd group subjects to control impulsive responding was responsible for this group's failure to learn the discrimination task.

Problem

It appears, then, that the operant approach to the study of anxiety neurotics and psychopaths has been relatively neglected. The focus of the present study was the establishment of differential reinforcers for these groups by means of such a technique. With this in mind, the following hypotheses were formulated:

1. Subjects whose personality patterns are characteristic of the anxiety neurotic will reveal a need to reduce stimulation from the environment and will increase their response frequencies for a given response when offset of stimulation serves as a reinforcer.

2. Subjects whose personality patterns are characteristic of the psychopath will reveal a need to increase stimulation from the environment. This will be reflected in an increase of frequency for a given response when onset of stimulation serves as a reinforcer.

3. Subjects whose personality patterns reveal neither appreciable neurotic nor psychopathic characteristics and who may be considered normal individuals may be expected, as a group, not to condition under either the onset or offset reinforcement situation in a predictable manner.

CHAPTER II

METHOD

Subjects

Forty-eight male subjects were selected on the basis of MMPI profiles available for all undergraduate students at the University of Florida. While it was recognized that this approach had certain diagnostic shortcomings, its relative reliability and standardization were imperative if meaningful classification into even such basic groups as those selected was to be achieved. According to traditional practice, an MMPI profile in which 4 and 9 are high points is usually interpreted as having been generated by individuals who frequently in the course of their lives "show some acting out behavior. They exhibit an enduring tendency to get into trouble with their environment, usually in ways that are more damaging to themselves and their families' reputation than to others" (Van De Riet and Wolking, 1963). This is in close accord with Cleckley's description of the psychopath noted earlier. On the other hand, Van De Riet and Wolking noted that individuals who produce MMPI's with 2 and 7 as high points have been found "to show depression, anxiety, insomnia, undue sensitivity, tenseness and nervousness." Symptoms of this nature, as well as a great deal of ruminative thinking, are characteristic of the anxiety neurotic. At any rate, it is likely that it requires individuals with rather diverse personality patterns to produce these contrasting protocols. Finally, an individual whose scores are not elevated beyond the 60th percentile nor drop below the 40th percentile is typically considered as relatively free of deviant tendencies.

While intergroup differences were found in Warren and Grant's study, with only a rather loose criterion for dichotomization, far more rigorous MMPI criteria were needed if the possibility of overlapping groups was to be minimized and a meaningful dichotomy was to be made. The following criteria were established:

Psychopaths. All validity scales below 65, scales 4 and 9 above 70, and all other scales below 70, with 2 and 7 below 60.

Anxiety neurotics. All validity scales below 65, scales 2 and 7 above 70, and all other scales below 70, with 4 and 9 below 60.

Normals. All validity scales below 65 and all other scales between 60 and 40. Furthermore, subjects who operationally belong in this category but whose profiles reflected tendencies to deviate in either of the above directions, were disqualified.

The experimenter examined all MMPI profiles of these descriptions and employed as subjects 16 students in each experimental group. Since the experimenter employed a split half design (see below), the number of subjects in each sub-group was eight.

Apparatus

The experimenter conducted his testing in a relatively quiet room which was darkened with the exceptions of a very small light used to facilitate recording of data and the illumination emitted by the reinforcement apparatus itself. The room was set off from a smaller anteroom so that external interference was minimized. The subject was separated from the experimenter by a 24-inch x 42-inch black plywood partition. In the center of the partition there was an 8-inch x 8-inch window which, depending upon the condition, was either left open or closed by means of black plywood. Eight colored 25-watt bulbs were wired in parallel around, but not below, the window on the subject's side of the board. These were red, yellow, blue and green (two each), and were placed approximately 6 inches apart. A small, inexpensive radio was wired to this circuit so that the lights and radio went on or off simultaneously. The response employed involved pressing a key. Since it was decided, however, to reinforce subjects for responses of given pressures rather than for merely random presses, a #54 spring was attached to a telegraph key to increase the range and the force necessary to emit a press. A wire pointer protruded from the key through a 2-inch x 4-inch opening centered at the bottom of the partition in such a manner that the force of a press could be measured by the height that the pointer rose along an aluminum scale on the experimenter's side of the partition. The total vertical range of the scale was 3 inches. This was divided into four 3/4-inch portions. These vertical segments were numbered accordingly, permitting the experimenter to reinforce selectively responses of given pressures. This apparatus was not seen by the subject, who saw only the key itself.

An "onset of mechanical stimulation" reinforcement (MO) required that the lights and radio be turned on simultaneously by the experimenter for three seconds following a correct response. The radio was tuned to various stations playing music and was kept at a constant, moderate volume. The correct onset of these devices was accomplished by means of a main electrical switch wired through a common electrical timing unit.

By switching a condition button to "onset" and pushing a "start" switch activating the timer, the experimenter was able to deliver a very reliable three-second MO.

The "offset of mechanical stimulation" reinforcement (MOFF) required that the lights and radio be continually on until the experimenter ceased such stimulation for a three-second period following an appropriate response. The switchbox on the experimenter's side of the partition provided for this condition through the electrical timer.

An "onset of human stimulation" reinforcement (HO) was also tested, requiring that the experimenter open the center window in order that a series of standardized movements be seen by the subject. The window was also opened for an "offset of human stimulation" reinforcement (HOFF).

Procedure

In accordance with a split half design, half of each group (normals, 49's and 27's) was tested only under the onset conditions while the other half was tested only under offset of stimulation. Each subject was tested individually and upon entering the room, was seated behind the partition. The subject was instructed as follows:

> In front of you is a small button. I want you to press it for the next 20 minutes. But please remember that after every press there is some data I have to record, so keep the button in the position that you have pushed it for a few seconds before starting again. I will tell you if you are going too quickly. It is not necessary to push the button all the way down each time but instead try to vary your presses a great deal. After the first 20 minutes is up, we will take a 10-minute break and do it again. That is all there is to it! Ready?

In the MO condition, a response of a given pressure (see below) was followed by three seconds of stimulation by lights and radio as described above. In the HO condition, the experimenter waved and nodded at the subject through the center window for approximately three seconds following an appropriate response. The experimenter had carefully rehearsed these gestures and a relatively standardized HO was given to all subjects involved.

During the MOFF condition, a correct response was followed by a three-second period in which ongoing stimulation, in the form of lights and radio, was stopped. Following these three-second periods, stimulation was continued automatically through the timed circuit. The HOFF condition required that the experimenter continually wave and nod at the subject in a carefully rehearsed manner until a correct pressing response was emitted. Following such a response, the experimenter stopped waving and nodding and looked down at his data for approximately three seconds. After this brief period, the experimenter again began his activity until another correct response was emitted.

According to an alternating schedule, each subject participated in either the MO and HO conditions or the MOFF and HOFF conditions. For both onset and offset groups, the mechanical and human conditions were counterbalanced to prevent fatigue and practice effects and the particular key pressures reinforced were also varied for the mechanical and human conditions. To minimize transfer in responding from the human to mechanical condition and *vice versa*, a pair of correct responses was randomly scheduled for each subject, each one of which was separated by an incorrect response. The pressures used for each subject were either 1 and 3 or 2 and 4 on the vertical scale described earlier. More clearly, if 1 (minimal pressure) was the correct response for the subject under the mechanical condition, then 3 would be the necessary response under the human condition. The same procedure was employed when 2 and 4 were the correct responses. Furthermore, the order of scheduling of even each member of this pair was randomized. Thus, it for one subject 2 was correct under the mechanical condition and 4 was correct under the human condition, for another subject the reverse might hold true. This, of course, was also the case when 1 and 3 were used as the pair of correct responses.

A 1:1 reinforcement schedule was employed and both mechanical and human reinforcement conditions, each lasting 20 minutes, consisted of a five-minute operant level period, a ten-minute conditioning period and a five-minute extinction period. Since there was a ten-minute break between the mechanical and human conditions (or *vice versa*), it took the experimenter about 50 minutes to test each subject.

The experimenter recorded the responses of the subject through each 60-second period of operant level, conditioning and extinction with the aid of a watch. All responses, rather than merely correct ones, were recorded in preparation for analysis.

CHAPTER III

RESULTS

The present study hypothesized that subjects whose personality patterns were characteristic of the anxiety neurotic as operationally defined in terms of an MMPI profile in which 2 and 7 were high, would show learning when a given response was followed by offset of ongoing stimulation. Conversely, it was predicted that psychopaths, as defined by 4 and 9 as MMPI highpoints, would increase their frequency for a given response when onset of stimulation was used as a reinforcer and that MMPI defined normals would show neither of these tendencies in a consistent manner. These hypotheses are borne out for the mechanical reinforcement situation in Table 1, which summarizes the findings of a type III analysis of variance (Lindquist, 1956, pp. 281-284).

While, of course, the significant Fs for diagnostic groups (D) and for diagnostic groups by onset vs. offset (D x O) were generated by the hypothesized behavior of the groups, the F of major concern is that of the three-way (within) interaction of learning period (P) x D x O. This highly significant F ($p < .001$) indicates that, as predicted, the different diagnostic groups were learning under different types of reinforcement. By inspection of the learning curves which have been plotted (see Figures 1 through 3), it is clear that the hypothesized differences in learning by the three diagnostic groups are quite large.

Table 1

Analysis of Variance of Responses under the Mechanical Reinforcement Situation (N = 48)

Source	df	MS	F
Between *Ss*	(47)		
D	2	9.44	5.49*
O	1	1.20	.70
D x O	2	26.00	15.12**
error (8)	42	1.72	
Within *Ss*	(96)		
P	2	2.59	3.05
P x O	2	.36	.42
P x D	4	2.78	3.27*
P x D x O	4	14.17	16.67**
error (w)	84	.85	
Total	[(143)]		

* $p < .05$
** $P < .001$

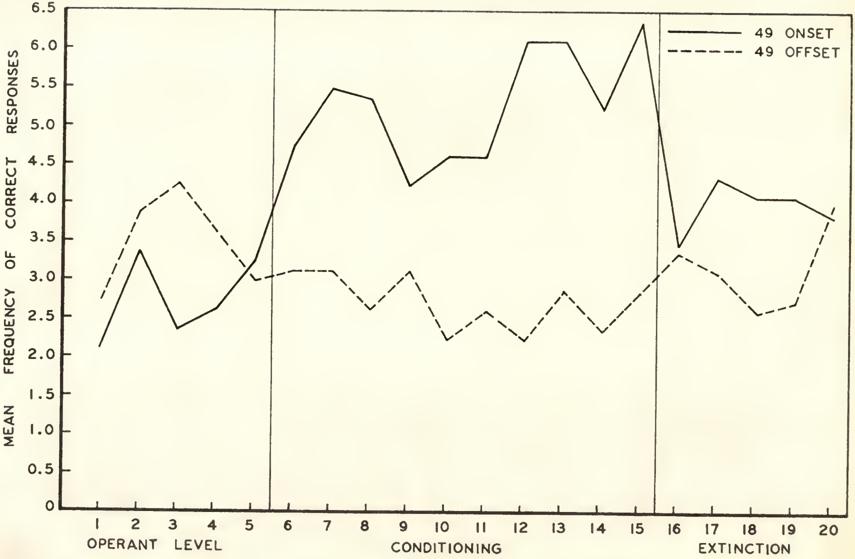

Fig. 1. Mean frequency of correct responses per minute for the 49 group under onset and offset of mechanical stimulation.

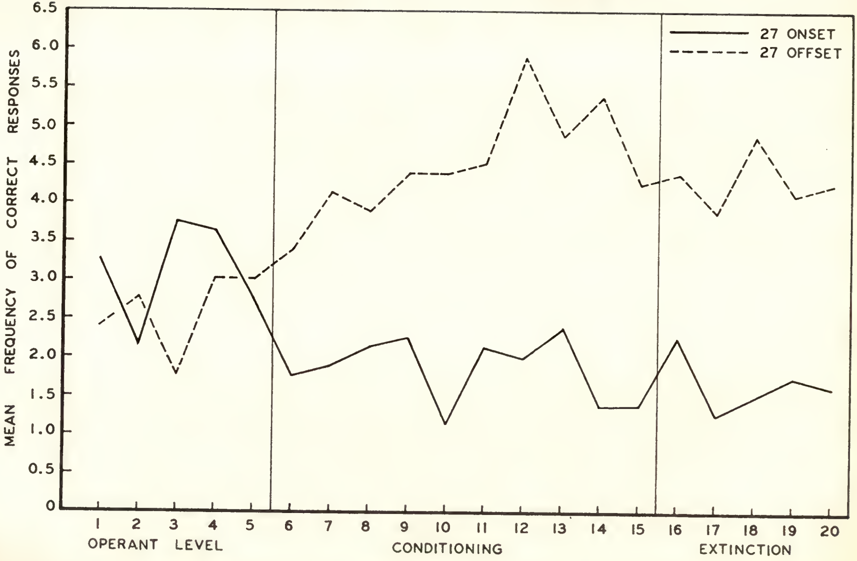

Fig. 2. Mean frequency of correct responses per minute for the 27 group under onset and offset of mechanical stimulation.

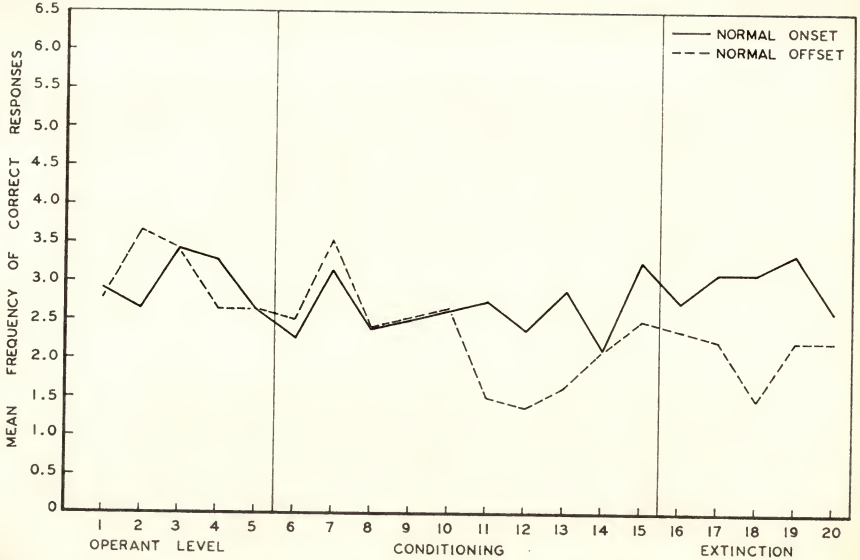

Fig. 3. Mean frequency of correct responses per minute for the normal group under onset and offset of mechanical stimulation.

By observation, it becomes apparent that not only did the 27 group fail to learn under MO, but actually showed a decrease in correct response frequency when the given response was followed by MO. This seems to indicate that this group learned not to respond or, more specifically, that MO served as a noxious stimulus for these highly anxious subjects. Since the curves are plotted on a minute-to-minute basis rather than cumulatively or in blocks, the large fluctuations from minute to minute are not unusual.

To examine further the group differences observable on the learning curves and to investigate more specifically the highly significant P x D x O interaction, _t_ tests were computed comparing mean response rates for the operant level, conditioning and extinction periods. These are summarized in Table 2.

It can be noted that the predicted learning of the 49 group under MO is substantiated with $p < .01$. There is also a significant loss of the correct response ($p < .01$) in extinction. The same pattern can be observed for the 27 group under MOFF, but while learning is significant with $p < .01$, the loss of the correct response during extinction is significant at only $p < .05$.

Interestingly, the tendency for 27 subjects to reduce their frequency of emission of a response followed by MO is significant with $p < .01$. While this pattern is also somewhat observable for 49 subjects under MOFF, no significance is reached.

As expected, normal subjects showed no learning under either MO or MOFF. Under both, in fact, there was a slight and nonsignificant tendency to reduce correct responses below operant level.

The human reinforcement situations (HO and HOFF) did not fare as

Table 2

Summary of t Tests for the Mechanical Reinforcement Situation

Group and Condition	Mean Operant Level	Mean Conditioning	t	Mean Conditioning	Mean Extinction	t
49 Onset	2.8	5.4	5.65**	5.4	3.9	3.26**
49 Offset	3.3	2.7	1.30	2.7	3.1	.87
27 Onset	3.2	1.9	2.83**	1.9	1.7	.43
27 Offset	2.6	5.4	6.09**	5.4	4.3	2.39*
Normal Onset	2.9	2.6	.65	2.6	2.9	.65
Normal Offset	3.0	2.3	1.52	2.3	2.1	.43

* $p < .05$
** $p < .01$

well as the mechanical method of reinforcement presentation. With the exception of the 27 group under HOFF, Figures 4 through 6 do not indicate a great deal of learning in the hypothesized directions. Table 3 presents the type III analysis of variance for these data.

The significant P x D x O interaction ($p < .01$), suggesting that certain groups showed learning under different reinforcers than others, justified the computation of *t* tests to study specific hypothesized effects. These data, which are presented in Table 4, indicate that significant learning occurred only for the 27 group under HOFF. The failure of the 49 group to learn under HO as predicted will be discussed later. The sudden increase in responding in minutes 3 and 4 of extinction under HO, observable in Figure 4, is difficult to account for but may be indicative of earlier response suppression. The large P x D x O F, especially in the absence of significant between variable F's, must be explained partially in terms of unpredicted three-way interactions which cannot be accounted for with any degree of clarity.

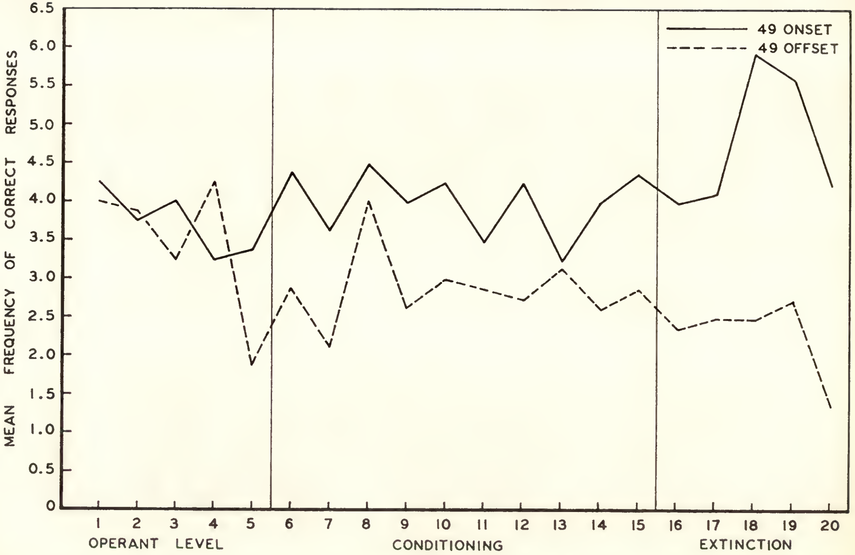

Fig. 4. Mean frequency of correct responses per minute for the 49 group under onset and offset of human stimulation.

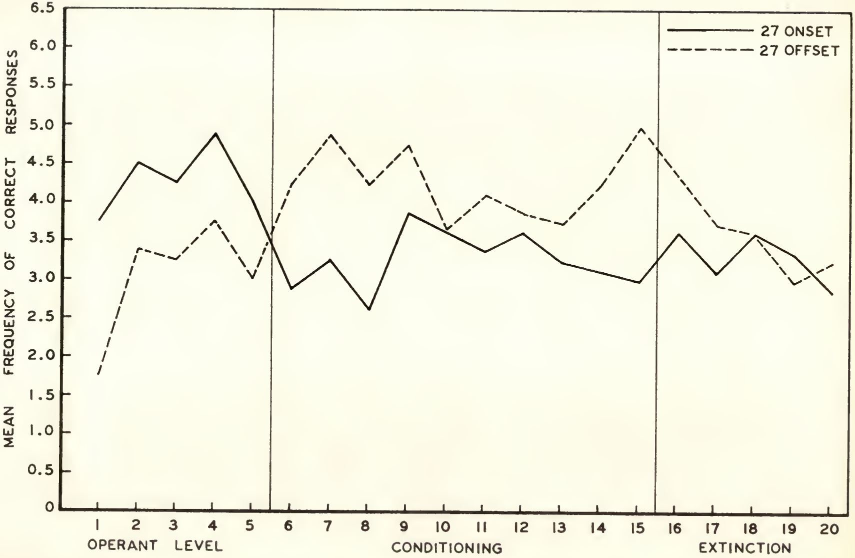

Fig. 5. Mean frequency of correct responses per minute for the 27 group under onset and offset of human stimulation.

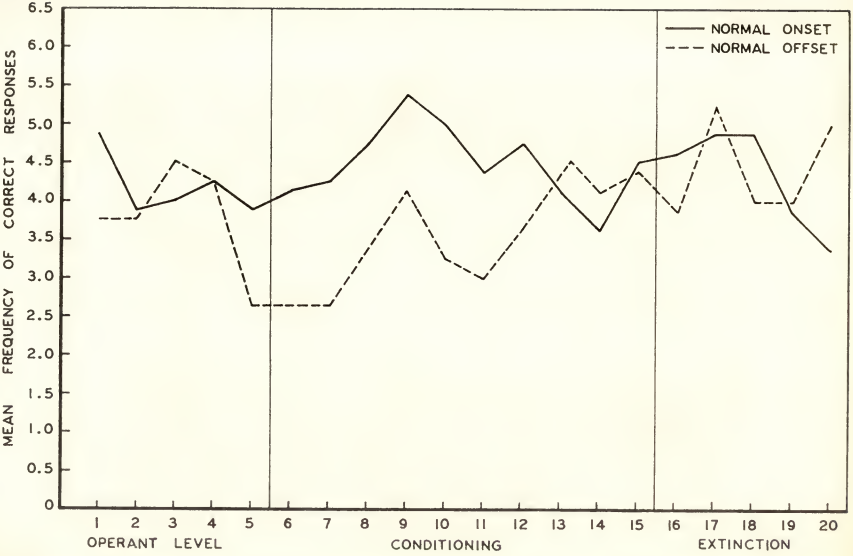

Fig. 6. Mean frequency of correct responses per minute for the normal group under onset and offset of human stimulation.

Table 3

Analysis of Variance of Responses under the Human Reinforcement Situation (N = 48)

Source	df	MS	F
Between _Ss_	(47)		
D	2	4.30	.59
O	1	9.66	1.32
D x O	2	7.58	1.03
error (6)	42	7.33	
Within _Ss_	(96)		
P	2	.12	.07
P x O	2	1.07	.61
P x D	4	.93	.53
P x D x O	4	6.54	3.76*
error (w)	84	1.74	
Total	[(143)]		

* $p < .01$

Table 4

Summary of t Tests for the Human Reinforcement Situation

Group and Condition	Mean Operant Level	Mean Conditioning	t	Mean Conditioning	Mean Extinction	t
49 Onset	3.7	4.0	.45	4.0	5.0	1.52
49 Offset	3.4	2.9	.76	2.9	2.3	.91
27 Onset	4.2	3.2	1.52	3.2	3.3	.15
27 Offset	3.1	4.8	2.58*	4.8	3.6	1.82
Normal Onset	4.2	4.5	.45	4.5	4.3	.30
Normal Offset	3.8	3.6	.30	3.6	4.4	1.21

* $p < .01$

CHAPTER IV

DISCUSSION

With the exception of the "psychopathic" group (49's) under HO, the highly significant statistical support for hypotheses 1 through 3 validates and extends the work of Petrie and lends justification to the use of the MMPI as an experimental instrument. Of still greater importance, however, is the re-evaluation of current thinking about the behavior of psychopaths and anxiety neurotics which these data suggest is necessary.

It must be emphasized again that these findings do not refute but merely augment and clarify existing theoretical formulations. Thus, the present finding that anxiety neurotics (27's) learn a response when it is followed by a marked reduction of environmental stimulation is in accord with Fenichel's (1945) economic concept cited earlier. In these terms, the need to reduce stimulation by each individual, as was found here, may well be influenced by a reduction of available psychic energy due to taxing internal conflicts. Conversely, the poorly developed superego and "perforated" ego of the psychopath may obviate internal conflicts to the degree that vast amounts of unattached psychic energy is available which is constantly expended in the search for new sources of environmental stimulation. Or, even more consistent with the orthodox view, the constant acting out of impulses may periodically reduce the tension level of the system to the extent that new sources of tension and stimulation must be found.

Since the hypotheses tested were generated by Petrie's findings, their validation lends support to the Reducer-Augmenter conceptualization as an important clinical approach. Furthermore, it permits greater scientific elegance than theories which, though more complex, are not necessarily more logically consistent nor more in accord with clinically observed behavior. There is, of course, no clearcut answer regarding the origin of these opposing tendencies and, while the learning explanation discussed earlier is a reasonable approach to the problem, heredity cannot be ruled out. These questions, however, are amenable to animal research and further discussion must follow the outcome of such experiments.

As can be observed in Figure 4, one marked deviation from the expected results was the failure of the psychopathic group to condition under HO. A possible explanation for this was the relatively monotonous stimulation offered by the experimenter as reinforcement for a correct response. In contrast to the vivid mechanical stimulation, the standardized nodding and waving offered as a reinforcer by the experimenter may simply not have served as sufficient stimulation to warrant similar responding by the subject. While this possibility cannot be overlooked, and further experimentation testing various kinds of human stimulation as reinforcers may reveal types of human stimulation which are, in fact, reinforcing to psychopaths, it is also conceivable that psychopaths are not motivated by human stimulation. This, of course, would be in opposition to Petrie's theory since she suggests that the Reducer, or now the term psychopath may be substituted, seeks sensory input of any variety and human stimulation also provides such input. Furthermore, an explanation of this kind would also be contrary to the majority of clinical evidence regarding the interpersonal problems often created by such individuals. For these reasons, then, it seems most likely that the human stimulation employed in the present study was insufficient to reinforce the responses of the subjects defined as psychopathic.

The effectiveness of offset of stimulation as a reinforcer was reflected in learning by the neurotic subjects under both the mechanical and human conditions. This implies that the anxiety neurotic's tendency to seek a reduction in stimulation is a somewhat more general phenomenon than the psychopath's need for stimulation. That is, the results indicate that the anxiety neurotic does not differentiate in terms of kind of stimulation to the degree that the psychopath does but seems, rather, to react to a broader category of sensory input as somewhat objectionable and worthy of avoidance.

While the normal group as a whole showed no significant learning under any of the reinforcement conditions tested, there were some subjects within this group who did increase their frequency of correct responding. Under MO, two subjects indicated learning; under MOFF, learning occurred for one subject. For the human reinforcements, however, four normals learned under HO while three learned under HOFF. Since normals showed some learning under both onset and offset of stimulation, it may be assumed that each has at least certain reinforcing qualities for some normal individuals. It is of interest, however, to note that, on the whole, more normals learned a response under the human reinforcement conditions than under the mechanical reinforcement conditions. This is in contrast to both the psychopaths and anxiety neurotics, more of whom showed learning under MO and MOFF, respectively, than under HO and HOFF. One might quite speculatively infer from these data that perhaps psychopaths and neurotics show a greater degree of stimulus generalization (or secondary reinforcement) than normal individuals who are concerned primarily with interpersonal stimulation.

An incidental observation which was in line with these findings was a clearly observable tendency for the anxiety neurotics, unlike the psychopaths and most normals, to emit sounds of surprise and fright following the first few onsets of mechanical stimulation. This is in accord with their significant decrease in frequency of correct responses followed by such stimulation. One such subject, having shown awareness through questioning by the experimenter, mentioned that he intentionally avoided making the correct response since it would cause the lights and radio to go on and he preferred to keep the room quiet and dark. This, then, supports the statistically significant finding that not only do anxiety neurotics seek offset of stimulation but that avoidance learning occurs in regard to new stimulation. This, again, may well account for the constriction of behavior observed in anxiety neurotics in clinical settings.

A point may be raised that the increase in correct responding for the psychopathic subjects under onset of mechanical stimulation and the anxiety neurotic subjects under offset of stimulation may be merely a function of increase or decrease of overall responsivity, and the neurotics' decrease in correct responding under onset of mechanical stimulation may be a function of an overall decrease in general responsivity. Even if this were the case, an overall increase in total number of responses could be said to be a function of the individual's increased attempt to obtain reinforcement (onset or offset of stimulation), leading to the incidental emission of a greater number of total responses. Furthermore, an overall decrease in total number of responses, if such were the case, for the neurotic subjects under onset of mechanical stimulation could readily be conceptualized in terms of generalized avoidence rather than a mere loss of responsivity. An examination of the data, however, obviates any consideration of increases or decreases of total response rate influencing the rate of specific correct responses. More specifically, taking the responses of the 27's under onset conditions, the percentage of responses which was correct tended to drop in conditioning for all but one neurotic subject that showed a decrease of correct responses under onset of mechanical stimulation. That is, during the first three minutes of conditioning the mean rate of correct responding for subjects showing a decrease was 16 percent while, of course, incorrect responding accounted for 84 percent. During the last three minutes correct responses constituted only 10 percent of mean total responses. Thus, the amount of decrease in responding was greatest for the "correct" responses, with no evident overall response decrease occurring. Again, this supports the concept that onset of stimulation is noxious to anxiety neurotics, leading to a reduction in those specific behaviors resulting in such stimulations. Similarly, all anxiety neurotics showed an increase in percentage of correct responding for offset of mechanical stimulation. The mean percentage of all responses which were correct for the first three minutes of conditioning was 30 percent, while correct responses constituted 44 percent of the total responses for the last three minutes. Of the psychopathic subjects that showed learning under onset of mechanical stimulation, all but one showed an increase in percentage of correct responses, as compared to total responses in the last three minutes of conditioning. More specifically, the mean percentage of correct responses for these subjects for the first three minutes of mechanical onset was 33 percent while incorrect responses accounted for the remaining 67 percent of total responses. For the last three minutes, however, mean correct responding jumped to 41 percent with only 59 percent incorrect responding. The general pattern, then, indicates that the learning of correct responses was responsible for the significant findings rather than a mere overall increase or decrease in total number of responses during conditioning, and that the increase of emission of correct responses occurred at the expense of incorrect responses.

Another noteworthy observation was an inclination on the part of many of the anxiety neurotics to interpret many of the experimenter's suggestions in an excessively literal manner. At the beginning of the ten-minute rest period, the experimenter suggested to all subjects that they might relax during this time and perhaps take a brief walk or take a drink of water if they were so inclined. While no data are available, it was quite evident to the experimenter that the anxiety neurotics, interpreting this quite literally, immediately went to the water cooler and began drinking. The psychopaths, on the other hand, tended to remain in the room and ask questions about the apparatus and the precise aim of the experiment. Normal subjects, for the most part, tended to leave and return at the appropriate time without particularly unusual behavioral patterns.

The response apparatus employed in the present experiment was designed in an attempt to elicit motor responses from subjects which would be somewhat analagous to the verbal responses of other experimentation. This was done to eliminate the possibility of introducing confounding verbal variables which may have differed for the three diagnostic groups. The apparatus employed dealt with the general response category of key pressing but, similar to verbal conditioning experiments, only certain classes of this response category were reinforced. More clearly, in a verbal conditioning experiment the experimenter may reinforce only plural nouns which are, of course, subsumed under the general response category of verbalization. The motor conditioning employed here depended not merely on the general category of pressing but allowed the experimenter to reinforce responses of given classes of pressure just as the verbal conditioner reinforces given classes of verbal responses. It is suggested that this might be a useful device for other experiments in this area.

Since the experimenter himself scheduled the subjects and therefore knew to what group each subject belonged, the possibility of experimenter bias must be noted. While for practical purposes this procedure could not be changed, due effort was made by the experimenter to remain fully aware of his reaction time in presenting reinforcement and to standardize his behavior to the greatest possible extent.

At the termination of each session, subjects were briefly questioned regarding their concept of what occurred during the experiment. While all subjects entertained some hypothesis about the meaning of the experiment, most were incorrect and no relationship was noted between awareness and conditioning.

Generally, the support obtained for the hypotheses tested has certain clinical implications which cannot be overlooked. Of greatest importance, most clearly, is the finding that anxiety neurotics and psychopaths differ quite significantly on a basic variable, response to stimulation. However, there is still no answer to the problem of causation in the etiology of these patterns. That is, it is not clear if neuroticism leads an individual to seek a reduction in stimulation as is the Freudian point of view, or if a perceptual tendency to augment, leading to a behavioral need to reduce stimulation, as is consistent with Petrie's theory, results in neuroticism. The same problem, quite obviously, exists in regard to psychopathy.

On a more operational level, three important concepts are recognizable. First, the finding that anxiety neurotics seek offset of stimulation while psychopaths seek onset might provide some improvement in the diagnostic criteria employed to delineate these differing disorders. Perhaps this might prove of considerable use in separating "neurotic" and "psychopathic" criminals, the necessity of which was discussed earlier.

Secondly, the treatment of psychopaths, a notoriously unsuccessful endeavor, has often involved placing them in quiet settings. If anything, such treatment increases their "sensory deprivation" and results in even further psychopathic behavior. Perhaps insuring adequate environmental stimulation in conjunction with other therapy would reduce this deprivation, permitting longer periods of relatively symptom-free behavior and improved progress. Conversely, the practice of getting highly anxious neurotics to participate fully in work and play activities may lead to their becoming so "stimulation shy" that they restrict their range of activity even more. A quiet and undemanding environment might obviate the necessity to avoid stimulation behaviorally. Of course, if operant conditioning therapy is to be used, appropriate reinforcers for these groups are apparent.

Thirdly, an important implication of the present study involves the system of personality evaluation and diagnosis most popular today. The major assumption underlying our most widely used diagnostic tools, projective tests, is that an individual will perceptually modify relatively neutral stimuli in accordance with his own unconscious needs. By examining projective material, one is provided with a basis for making general inferences regarding a patient's basic motivations. Another, and perhaps less speculative way of learning about an individual's needs is to observe precisely what he will and will not expend effort to obtain. More specifically, the determination of what reinforcer will lead to an increase of frequency for a given response also yields information regarding that individual's motivation. Thus, by showing that an individual responds for increased stimulation, one provides data indicating that the patient is more psychopathic than neurotic.

What is being suggested, then, is a system of diagnosis based on determining what reinforces an individual's behavior, or what the differences are among the hierarchies of reinforcers for different diagnostic groups. With the development of such a system, eventually it might be possible to differentiate patients solely on the basis of the pattern of reinforcers which are effective in modifying their behavior. To be less operational, the approach would meaningfully separate groups of people according to those "things" which are essential to them, through the pursuit of which they may have developed their symptoms and for which they will even modify their present abnormal pattern of behavior.

Perhaps it would overcome some of the inadequacies of the present overworked and undervalidated diagnostic system.

CHAPTER V

SUMMARY

The present study focused on the theme that individuals whose behavior patterns were characteristic of the anxiety neurotic augmented the intensity of incoming stimulation and consequently experienced even relatively moderate stimulation as traumatic. Conversely, psychopathic behavior was considered a tendency to subjectively reduce the intensity of stimulation resulting in a constant state of "sensory deprivation," and a continuous need to obtain additional stimulation. The etiology of these opposing patterns was discussed in terms of learning theory and of Freudian concepts which they were considered to complement.

It was hypothesized, therefore, that anxiety neurotics would reflect a need to avoid stimulation and would learn when offset of stimulation served as a reinforcer. It was further predicted that psychopaths would, conversely, reveal a need to obtain stimulation by learning a response when it was followed by onset of stimulation. Finally, it was hypothesized that normals would not, as a group, show learning under either onset or offset of stimulation.

MMPI criteria were used as operational definitions for selecting subjects. Subjects were contacted by mail and all were male volunteers. The N of 48 consisted of 16 anxiety neurotics, 16 psychopaths and 16 normals. In accordance with a split half design (onset vs. offset), each group was divided in half.

Individual testing was carried out in a dark, quiet room. The subject and experimenter were separated by a partition with a closeable window in the center. Eight colored light bulbs were wired on the subject's side of the partition. A radio and timer were connected to the circuit so that lights and radio worked simultaneously. Since a key pressing response was involved, a spring was attached to a telegraph key and a pointer protruded through the partition to the experimenter's side. The amount of pressure exerted by the subject could be read by the experimenter on a four-point scale.

Each subject was told merely to press the key, hold it in the position pressed for a brief period, and then to release it and begin again. Every subject participated in both a mechanical and human stimulation condition, each consisting of a five-minute operant level period, a ten-minute conditioning period and a five-minute extinction period. Onset of mechanical stimulation was a three-second period of lights and radio while human stimulation involved a three-second period of waving and nodding by the experimenter. Offset conditions merely involved three-second periods of cessation of these stimuli.

A 1:1 reinforcement schedule was used and the responses designated correct (1, 2, 3, or 4) were randomly determined for each subject and alternated for each condition (human or mechanical) as were the conditions themselves. Thus, a relatively free operant conditioning situation was achieved, the experimenter recording responses through each 60-second period.

Analysis of variance and t tests confirmed the hypotheses at a highly significant level ($p < .01$), the only exception being the psychopaths' failure to learn under the human onset reinforcement. This was discussed largely in terms of the inadequacy of the human stimulation reinforcement employed.

The results imply that anxiety neurotics, seeking a reduction in stimulation, might benefit most from a quiet and undemanding therapeutic environment. Psychopaths, however, might be aided in their therapeutic progress by controlled alleviation of their "sensory deprivation" (i.e., stimulation) to reduce antisocial acts aimed at obtaining such stimulation. A diagnostic system based on establishing differential reinforcers for various types of patients was also proposed.

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APPENDICES

APPENDIX A

Table 5

Mean Correct Responses of Subjects under Onset and Offset of Mechanical Stimulation

49			27			Normal		
OL	C	EXT	OL	C	EXT	OL	C	EXT
1.8	7.1	4.2	2.2	0.6	0.0	2.6	3.8	4.2
2.8	7.7	5.2	2.6	2.2	2.2	1.2	0.8	0.1
3.2	6.1	3.8	2.2	1.6	1.0	2.8	3.8	6.2
2.2	4.2	2.4	4.2	1.5	2.0	4.6	3.6	3.6
4.4	4.1	3.0	2.2	2.8	2.4	1.8	1.4	1.8
1.8	4.3	4.2	2.8	1.8	1.6	2.2	1.7	1.0
3.8	3.0	3.4	2.6	0.3	0.4	4.8	3.7	4.2
2.2	6.3	5.0	6.4	4.1	3.8	3.4	2.2	1.8
1.6	1.2	1.0	2.4	2.9	2.8	2.8	3.3	3.2
3.2	2.9	2.8	2.0	4.6	3.4	3.0	3.0	2.0
3.2	2.8	2.0	3.8	5.5	4.6	3.6	1.0	0.2
1.8	1.8	2.2	1.8	5.8	4.2	3.8	2.4	1.8
3.6	2.9	3.6	1.2	3.0	2.0	0.8	2.5	2.8
5.0	3.2	6.0	2.4	9.0	7.2	1.8	1.6	2.0
1.8	2.1	1.8	4.0	5.9	4.2	3.4	2.4	3.2
6.2	4.9	5.4	3.0	6.2	5.8	4.8	2.3	1.8

APPENDIX B

Table 6

Mean Correct Responses of Subjects under Onset and Offset of Human Stimulation

49			27			Normal		
OL	C	EXT	OL	C	EXT	OL	C	EXT
2.4	9.7	12.4	3.2	2.5	2.4	4.8	3.5	4.8
4.4	3.1	4.4	4.8	4.1	4.6	5.2	7.4	5.0
4.6	1.9	3.6	5.2	3.7	6.4	4.0	4.1	4.6
6.6	6.2	9.2	3.2	1.9	1.6	3.4	4.1	3.2
1.8	2.4	2.2	4.8	2.4	0.0	2.6	3.2	3.6
2.6	2.8	2.0	6.4	7.4	7.0	6.4	5.9	8.0
2.8	3.4	2.2	4.6	3.0	4.2	1.6	1.1	1.4
4.4	2.7	3.6	1.8	1.0	0.4	5.8	6.4	4.0
3.6	3.5	2.6	3.6	2.4	2.4	4.4	3.3	2.6
3.2	1.7	1.0	4.4	7.2	4.4	1.4	3.0	3.6
3.8	4.1	3.0	2.2	4.8	5.0	4.0	4.9	8.6
3.8	2.8	4.4	1.4	7.6	4.2	3.6	3.8	6.4
4.0	4.0	2.8	2.0	2.2	1.0	4.4	4.4	5.4
3.2	1.5	0.4	4.2	6.0	4.6	4.2	2.3	3.0
2.6	2.7	1.6	3.8	2.8	2.6	2.6	4.6	3.6
3.2	2.7	2.6	3.0	5.2	4.0	5.6	2.1	2.2

BIOGRAPHICAL SKETCH

Allen E. Wiesen was born in New York City, New York, on May 5, 1939. In June, 1957, he was graduated from the Bronx High School of Science in New York City. He attended Hunter College of the College of the City of New York from 1957 to 1961, receiving the degree of Bachelor of Arts in June, 1961. He entered the University of Florida Graduate School in psychology in September, 1961, under a nonresident tuition scholarship, and served as a graduate assistant for the spring term of 1962. Mr. Wiesen received the degree of Master of Arts from this institution in April, 1963, and since then has been engaged in fulfilling the requirements for the degree of Doctor of Philosophy. He is presently a holder of a U. S. Public Health Service Fellowship which he was awarded in September, 1962.

Allen E. Wiesen has been a participant in the Veterans' Administration psychology trainee program and has spent the summers of 1962 and 1963 as a trainee at the Veterans' Administration Hospitals at Coral Gables and St. Petersburg, Florida. In June, 1964, he began his internship under this program at the Veterans' Administration Hospital, Augusta, Georgia.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

April 24, 1965

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